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There is no necessity at the present day for an argument in favor of the existence of the slight contractions of the urethral canal known as strictures of large calibre. The work of Dr. Otis in this country, Mr. Teevan in England, MM. Guyon, Terrillon and others in France has shown conclusively that such contractions may be of considerable importance; and the general phenomena associated with them now constitute a group familiar to every genito-urinary specialist. The patient will present himself with the following symptoms, often so slight that he is inclined to apologize for seeking professional advice, and sometimes elicited only by careful questioning. He will have noticed that in the mornings the

[1] A translation of this article is published in the current (November) number of the *Annales des Maladies des Organes Génito-Urinaires*, edited by M. Felix Guyon.

lips of the meatus urinarius are glued together, and that on separating them a drop of whitish, opalescent fluid makes its appearance. Micturition will be found to be slightly more frequent than usual, and the patient will particularly describe a slight haste and urgency to begin the act, which in its actual performance is a little slow and somewhat imperfect. At the end of urination, unless he pays especial attention to shaking and stripping the penis, there will be a dribbling of a certain amount of urine, varying from a few drops to a drachm or two. He will often complain of a dull aching sensation in the lumbar region and of a similar feeling in the hypogastrium, or occasionally of a neuralgic pain in one or both testicles. I have elsewhere explained[1] what seems to me the *rationale* of the development of these symptoms, and I reproduce a portion of that explanation here as a fitting introduction to a few cases which I desire to place on record.

To account for the symptoms above mentioned, and for their cause, there are certain general physical and physiological laws which should be recalled. Persistent irritation, such as that which results from frequent or protracted attacks of gonorrhœa, causes at any given point in the body an increase in the fibrous tissue of that region, and the deposit or development of new tissue of a similar character. This is espe-

[1] *International Encyclopædia of Surgery*, Vol. II.

cially true of mucous and submucous surfaces, and still more particularly of the urethra, which, by its anatomical peculiarities, offers peculiar facilities for the production and organization of inflammatory products. Such a deposit, occurring in the submucous structures around the urethra, interferes to a greater or less extent with the lumen of that canal and thus constitutes a stricture. Once deposited, here as elsewhere throughout the body, this new tissue tends to contract more or less steadily and continuously. This is in consonance with a well-known pathological law; and the contraction is no more noticeable here than when it occurs in the intertubular spaces in interstitial nephritis, strangulates and destroys the parenchyma of the liver in cirrhosis, produces induration and bronchiectasis in chronic pneumonia, limits the movements of inflamed joints, distorts or deforms after burns and scalds, or in any of the many possible directions exerts its power in the production of disease. We have, then, it must be admitted, in urethritis, a sufficient cause for the production of a condition which tends gradually to diminish the size of the urethra and to interfere with its dilatability.

In studying the effect of this condition in producing the symptoms that have been detailed, certain other physiological laws must be taken into account. Habit is a powerful agent in facilitating and controlling

the functions of animal life. Illustrations of this fact in other systems than the genito-urinary are frequent and familiar. But to take up the case in question, it is safe to say that in a healthy adult, a certain equilibrium has been established and maintained between the usual efforts and powers of the bladder as an expulsive organ, and a certain average amount of resistance which must be overcome before it can empty itself. At the age of twenty-one years, this adjustment of force depends upon a large number of previous distinct acts of micturition. This balance between the force of expulsion and its work cannot with impunity be disturbed, and even a slight interference with the calibre of the urethra tends to produce such disturbance.

Apart from the proclivity to muscular spasm in the neighborhood of and behind every stricture, this interference with the action of the bladder arises from the encroachment of the new deposit upon the urethral calibre. It is a law of hydrostatics that, if a current of liquid be passed along a tube, a certain degree of friction proportionate to the amount and velocity of the current and the size of the tube takes place between the walls of the latter and the liquid; if the tube be narrowed at any one place, the friction is increased at that point, and, to avoid a diminution in velocity, the propulsive force behind the liquid must also be correspondingly increased.

Still another point must be mentioned before I turn to the group of symptoms, the occurrence of which after so many cases of gonorrhoea I shall endeavor to explain. The act of micturition is one requiring for its perfectly normal performance: first, the relaxation of certain muscles to secure patency of the urinary channel; and, next, the thorough and complete contraction of those muscles to produce entire evacuation of the contents of the passage. The latter portion of this act is accomplished by the contraction of the circular muscular fibres which surround the urethra, and which, in a healthy condition, serve to bring and retain its walls in close apposition during the intervals of urination. The submucous deposit which increases the friction of the stream of urine at any point, also interferes with the accurate closure of the canal by those muscles whose action is impeded, and whose structure itself is in part often invaded, and as a consequence we have imperfect emptying of the urethra at the end of urination. Finally, if in addition we recall the intimate nervous connection of the urethra with all the viscera of the abdomen and pelvis, and with the walls of those cavities, and the reciprocal relations that exist between them, we are in a position to sum up the relation of the pathological and subjective phenomena as follows:

The increased friction and resistance resulting from even a slight fibrous peri-

urethral deposit disturb the normal relations of the bladder, and, by rendering it irritable, bring on one of the common symptoms of stricture, frequent micturition. The imperfect closure of the tube, the muscular action of which at the point of deposit is materially interfered with, causes the equally imperfect expulsion of the last drops of urine, and produces another characteristic symptom—dribbling at the end of micturition. The retention and decomposition of these last drops, together with the abnormal friction between the stream of urine and the urethral walls, gives rise to a subacute inflammation of the mucous membrane, accompanied with a catarrhal or muco-purulent discharge, constituting the condition of gleet; while pains in remote organs and situations, notably in the lumbar and hypogastric regions, are developed by reflex irritation transmitted from the area of inflammation.

This relation of causes and effects has been in the main accepted as correct by the profession for many years. Probably no one denies that in certain strictures in which the urethral calibre is markedly diminished, the connection between the pathological changes and the observed indications is about as has been stated. The differences of opinion which now exist are chiefly as to the amount of urethral contraction which is sufficient to produce noticeable effects.

That every urethral coarctation following

on urethritis must at some time have been a stricture of large calibre, is self-evident, but just when such a stricture becomes an active pathological factor, and is able in the manner indicated to give rise to symptoms, is an unsettled point. Indeed, it is not probable that it ever can be definitely determined. The idea that any particular fixed calibre represents the normal condition of the urethra has long ago been abandoned, the observed variations of that canal being such that no special dimensions can be assigned to it as representing the precise dividing line between health and disease. The old method of regarding the size of the meatus as an indication of the normal calibre of the canal behind it, is also unquestionably fallacious, it having been conclusively shown that no more definite relation exists between them than between any other mucous canal and its corresponding outlet—the mouth and the œsophagus, for example, or the anus and the sigmoid flexure. That there is a certain correspondence between the size of the urethra and that of the flaccid penis, is true, the calibre of the one increasing with the circumference of the other, but that this ratio is present in any absolutely unvarying manner, has not yet been demonstrated. At the most, the size of the penis may be said to furnish a general indication of the urethral dimensions, but one which is approximate merely. On the other hand, it has been shown that there

are usually certain normal variations even in the spongy portion, which is now claimed with much show of truth as the most common seat of pathological contractions, and that it is impossible with any of the means at our command to distinguish between these natural irregularities and coarctations of equal calibre due to incipient stricture.

An illustration of what I refer to is found in the following case: A muscular and apparently robust man, aged about 55 years, was admitted to my wards in the Philadelphia Hospital, suffering from a leg-ulcer. No urinary trouble was suspected until he was subjected to an examination for the purpose of verifying a theory to which I shall presently allude. He was then found to have a coarctation at the distance of four and a half inches from the meatus. There were no marked subjective symptoms whatever: micturition was possibly a little too frequent, and was not quite complete, a slight dribbling following the flow of urine; there were obscure lumbar and hypogastric pains, and occasional neuralgia of the glans penis; but these facts were only elicited after careful questioning. A No. 28 steel sound passed into the bladder without the slightest perceptible difficulty, but the patient complained of pain extending from the peno-scrotal junction to the perineum. An examination with a bulbous bougie, No. 24, revealed a stricture situated in the spongy portion of the urethra at the point

mentioned, about four and a half inches from the meatus; No. 26 bulbous could be passed only with great trouble.

Dilatation was commenced, but an attack of some intercurrent disease—pneumonia, I believe—caused the patient to be transferred by one of my internes to the medical ward, where he soon after died. At the autopsy I carefully removed the genito-urinary organs, on the appearance of which I have the following notes: The penis was of average size, the pendulous portion measuring about four and three-quarters inches in length, and a little over three inches in circumference. (This would have fixed the normal calibre of the urethra, according to Dr. Otis's standard, at about thirty-one millimetres.) Upon dividing it along the dorsum a band of fibrous structure was seen almost encircling the urethra four and a half inches from the meatus; extending from a point a little anterior to this back to the bulb of the corpus spongiosum and to the crura of the corpora cavernosa was an area of intense congestion, which persisted even after maceration of the specimen in chloral solution for two weeks, and was then plainly noticeable across the room at a class demonstration; the bladder was dilated and hypertrophied and the ureters slightly dilated; the kidneys were healthy; there was no enlargement of the prostate. Two small patches of ulceration existed on the floor of the membranous urethra, each measuring

about two lines in diameter. A microscopical examination of the constricting band was made by Dr. Shakspeare, Pathologist to the Philadelphia Hospital, with the following result: "The section which I made of the stricture submitted for examination by Dr. White included the mucous and submucous tissue. Longitudinal sections were made after the specimen had been hardened in alcohol. These, after staining in carmine and mounting in dammar, exhibited under the microscope a great increase of the fibrous portions of the submucous tissue. Among the fibrous bundles were numerous typical, curly, elastic fibres.

"It was also noticeable that the walls of the capillary vessels running toward the mucous surface were very thick and fibrous (sclerosed). The inflammatory processes were in the last stages, as was evidenced by the sparseness of cellular elements scattered throughout the fibrous portion."

This case is, in my opinion, one of a large class formerly often overlooked, and still neglected or misunderstood by those practitioners who adhere to the old methods of examination.

As lately as 1875 Sir Henry Thompson said: "When a young man consults you for certain troubles relative to which you desire to learn whether urethral obstruction be a cause or not, do not be tempted for an instant to adopt so unnecessary a course as the introduction of very large instruments

or instruments with huge bulbs at the end of them; but simply take a flexible English gum-elastic bougie well curved toward the point, with a blunt end not larger as a rule than number ten or eleven of our scale, and pass it very gently and slowly into the bladder. If it goes easily—above all, if it is withdrawn without being held and slides out with perfect facility—take my word for it he has no stricture, and, *quoad* obstruction wants no use of instruments whatever." He says elsewhere, however: "With the bulbous bougies (various sizes) you may determine the existence of any narrowing in any part of the urethra with great accuracy, and for many years I have never operated without employing them carefully beforehand." I infer from the context of his lectures on the urinary organs, that he refers in this last remark rather to the locating of strictures already discovered than to their original detection. The value of the *bougie à boule* in the diagnosis of strictures is now so universally recognized that no argument in its favor seems necessary, but I desire *en passant* to call attention to one source of error which is associated with their use in the deep urethra and which is not infrequently overlooked. Years ago I published (The *Philadelphia Medical Times*, May 26, 1877) a paper giving the results of some investigations into the relation between onanism and urethral stricture, which led me to examine a large number of

persons with healthy urethræ. In these examinations I found that without exception at a distance varying from 5½ to 7½ inches from the meatus the *bougie à boule* was arrested during its withdrawal from the bladder, and that the obstacle which was there encountered gave to the hand of the surgeon the characteristic sensation so familiar to those who have used this instrument in cases of stricture. It was evident that this condition could not be an abnormal one and its explanation was sought and I believe found in the anatomy of the curved portion of the urethra.

Any extended consideration of this would be inconsistent with the limits and purpose of this paper; but there are one or two points which seem to me worthy of special mention. Directly beneath the symphysis pubis the urethra perforates the posterior or visceral layer of the deep perineal fascia. A little in advance of this point is the anterior layer of the same fascia, continued round the under surface of the urethra, becoming lost upon the bulb and filling in the sub-pubic arch from in front. Between these two layers, which are often described as the triangular ligament, are found various vascular structures, important muscles, Cowper's glands, and the membranous urethra. It is said that the anterior layer exerts the larger share in stopping the progress of an instrument inward, owing to the fact that just in front of it is the freely

movable and dilatable bulbous portion of the urethra, permitting considerable motion in the point of the sound, which is suddenly arrested at the commencement of the membranous urethra by this firm fibrous anterior layer. This is probably true; but it is capable of demonstration that the posterior layer, for analogous reasons, offers a similar opposition to the free withdrawal of a bulbous bougie. The prostatic urethra being at once more movable and more dilatable than the membranous portion, the bulb slips smoothly along it until the point is reached at which this layer of fascia closely embraces the posterior part of the membranous urethra and the outer surface of the prostate.

Here for obvious reasons it is arrested, and it is at this moment that the deceptive sensation which may be considered indicative of the existence of organic stricture is communicated to the hand.

A series of observations and dissections upon the cadaver confirmed me in this view, which was originally purely theoretical, and moreover eliminated the possibility of the resistance being due to a spasm of the compressor urethræ muscle which surrounds the canal at this point, arrest of the instrument occurring just as invariably after death as before.

The possible progress of the case described above, to which we may now return, had it not been interrupted by acute disease and

death, can be easily stated. In consequence of the imperfect emptying of the urinary tract, cystitis would sooner or later have resulted, and would probably have been regarded as the primary disease if the urethral coarctation had remained unrecognized. Pyelitis, or infiltration of urine, or both, would have followed, and would possibly have caused death by uræmic or pyæmic poisoning. It is of course admitted that the case is in many ways an unusual one. With the same amount of existing disease the subjective symptoms would ordinarily be much more marked, or the contraction giving rise to it would be of smaller calibre: actual ulceration is rare in these conditions, and an involvement of the urinary tract posterior to the bladder was hardly to be expected where there was so little obstacle to the stream of urine. The dilatation of the ureters in this case was probably due to the increased frequency of urination and the periodical obstruction thereby produced in the flow of urine into the bladder; at least, that seems to me a possible explanation. The facts remain, however, that the conditions which were found were simply exaggerations of the pathological processes which beyond a doubt result from any infringement upon the normal calibre of the urethra. I may select a few cases from my private practice to illustrate the same point.

Case I.—A man 30 years of age, a

hotel-keeper in a neighboring city, applied to me some months ago on account of a troublesome gleet which had persisted for several years. It was of the most trifling character, came from the deep urethra, and was associated with the symptoms mentioned above: frequency of urination, dribbling, and slight hypogastric pain. He had, before coming to me, tried various methods of treatment, among them the use of steel sounds of a calibre of 26 and 28, which were as large as his meatus would admit and really seemed to distend the whole urethral canal. Thinking that the course had been insufficient in duration I recommended persistence in that method of treatment, ordering a 29 instrument which caused considerable pain at the end of the penis. He used this, with and without various injections and different methods of internal treatment, with no effect whatever. He became much discouraged and finally agreed to allow me to enlarge the meatus, a procedure which I had originally recommended but had not urged, as he was excessively nervous and as the aperture was of more than the average size. After doing this I ordered a No. 30 steel sound, intending gradually to increase the size of the instrument, but from the first week during which that size was employed his symptoms absolutely disappeared and he has never had any return.

I am of course aware that the result in this case may be attributed to the enlarge-

ment of the meatus. Ever since Mr. Furneaux Jordan called attention to the possible results of a congenitally small urinary meatus in males and females and recorded cases of urethritis, prostatitis, cystitis, and epididymitis due to this cause, it has been recognized as an occasional source of this and other genito-urinary diseases. Supra-pubic pain, frequent micturition, lumbar pain, hæmaturia, preternatural sexual excitability are all in my own experience distinctly referable to contraction of the meatus and I must therefore admit that in the above case the enlargement of that opening may have been the active factor in producing a cure. As it would have naturally received a No. 28 sound with ease and a No. 29 with the use of a little force, it seems hardly likely however that its incision had much to do with the subsequent result.

Case II.—A gentleman aged 45 years, a widower, came to me on account of sexual disability characterized by imperfect erections and premature ejaculations. He had never had any venereal disease and had been happily married for many years, having a large family of healthy children. After the death of his wife there was a prolonged period of continence, at the end of which, under the influence of urgent sexual desire, he attempted intercourse on several occasions with entire want of success. He had been carefully and intelligently treated by his family physician, a man of large experience,

and had used, as there was hyperæsthesia of the deep urethra, a steel sound No. 30, which he had introduced for himself twice a week for a period of some months. In addition to this, much judicious treatment had been employed. A physical examination gave absolutely negative results. The therapeutics of his case had been so comprehensive that I scarcely knew what to recommend, but, pending an examination of his urine, directed him to get a No. 31 sound and to insert it at the usual intervals, intending gradually to increase the size if the urethra would permit it. He disappeared for a few weeks from my office, at the end of which time he returned to report that he considered himself entirely cured, having for the first time for years had sexual connection. His cure has proved to be permanent.

Case III.—A gentleman aged 48 years, but remarkably youthful and vigorous for his age, came to me recently in great distress, giving the following history: He had been the subject of one or two gonorrhœal attacks early in life and had subsequently had a slight urethral contraction, for which he had been treated by gradual dilatation. He had been accustomed all his life to having regular and frequent sexual intercourse, but about a year previous to his visit to me had become engaged to a young and attractive woman for whom he had great respect, and had for that period been entirely continent. A month ago he told me he

had been married, and to his dismay and mortification found that he was unable to perform the sexual act, erections being imperfect or fleeting, and ejaculation occurring prematurely. He had used his steel sound No. 28 without apparent benefit. No stricture or other abnormal condition of any kind was discoverable by the most careful examination, and, considering his years, he was apparently a model of physical health. I recommended the preliminary use of a No. 30, which went in with slight difficulty, and gave a cautious prognosis to prepare him for a somewhat extended course of treatment. To his and my own surprise and gratification, however, after a week or ten days the only distinct subjective symptom which he had had, a neuralgic pain in the right testicle, disappeared and shortly after he without difficulty established natural sexual relations with his wife.

Case IV.—A gentleman aged 30 years, a merchant of large interests whose business required constant visits to a neighboring city, applied to me for treatment for a condition of irritability which gave him great annoyance. He found that he was unable to retain his urine for more than two or three hours at the most, and on starting from his office for the water-closet, or more particularly on arising from his seat in a parlor-car to go to the urinal at the end of the car to empty his bladder, he would find great difficulty in controlling the desire, the

urine sometimes escaping before he had time to unbutton his clothes. He had no other marked symptoms, but had been carefully examined by different practitioners for vesical calculus, stricture, prostatic disease, etc. His urine showed nothing abnormal. He had been instructed in the use of the steel sound and was then employing a No. 30, which certainly seemed to be a full size. I repeated the examination which had been made by my predecessors and found nothing to account for his trouble. As his visit to me came shortly after my experience with one of the cases recorded above, I advised him to get a No. 31 steel sound, although he felt quite sure that he would not be able to pass it, the 30 distending the urethra so completely. I thought it was worth the trial, however, although I was disposed to consider his case an example of the urethral erethism so frequently seen in railroad employés and to a less degree in commercial travelers, and resulting doubtless from spinal congestion consecutive to the continual jarring experienced in railroad journeyings. While I was yet undecided as to what further treatment I would recommend, he returned to report the almost complete disappearance of his symptoms following the first week's employment of the larger-sized instrument.

I have seen a number of similar but less striking examples of the same general truth, which it seems to me may fairly be expressed as follows: A difference in the size of

urethral instruments employed for dilatation, so slight as to seem trifling and unimportant, may result in exceptional instances in a therapeutical effect far beyond what would be ordinarily anticipated; the practical conclusion from which is that, other means having failed or definite indications for other treatment being absent, we should never stop short of *full* dilatation in disturbances of the genito-urinary functions, the treatment being harmless in itself and sometimes so unexpectedly beneficial. While there is nothing new about these observations, it has yet seemed to me that even with genito-urinary specialists who are thoroughly familiar with the modern views in regard to strictures of large calibre, and certainly with general surgeons who do not always accept these views as a guide in practice, treatment is often defective on account of a failure to recognize that a slight difference, even that of one millimetre, in the circumference of the dilating instrument, may sometimes make considerable difference in the results obtained.